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SETAE.

BY G. F. FERRIS,

Stanford University, California.

Nearly all insects are in some degree beset with hair-like structures of varying length and stiffness and density and frequently of varying color. So much is familiar to every entomologist, even to those who have never examined an insect with a magnification higher than that of a hand lens. But it is only when one becomes accustomed to studying insects primarily from microscopic preparations that attention becomes definitely focused upon these structures and a proper appreciation of their wide variety of form can develop.

A very large amount of confusion has existed, and exists even today in spite of the efforts of the writers of text books, in the terminology to be employed for the various types of dermal excrescences. Spines, setae, hairs, chetae, bristles, aculei, trichiae, scales, tubercles, are terms that have been used with a considerable degree of flexibility and a certain amount of interchangeability. Comstock and others have recognized two fundamental types. In one, whatever its size or shape, the process is continuous with the body wall and is generally produced by more than one undifferentiated dermal cell. These are *spines*. In the other type, the structure is produced by a single enlarged cell and the continuity of sclerotization is interrupted, the structure being set in a socket or alveolus to which it is attached by a membranous connection. The process in such cases is a *seta*. In some cases the rim of this socket may be strongly differentiated and it may sometimes be sclerotized when the remainder of the derm is not.

This distinction is undoubtedly valid and setae as thus defined, are a very definite morphological element. But whether, once this primary classification is established, it is possible to achieve a still greater precision in the nomenclature of the different types of setae is doubtful. The various forms grade into each other in such a manner that sharp limitations of type do not exist. Stiff, spine-like setae pass on the one hand into slender, flexible hairs and on the other into flattened scales, and so with all the other forms. Possibly scales such as occur on the wings of Lepidoptera, in which there may be special developments, can be defined as a distinct type, but scales in many other insects can not. In general it appears that simple descriptive terms will suffice and that an elaborate nomenclature with a pretentious and factitious appearance of precision is uncalled for. Thorn-like setae, tubercle-like setae, bristle-like setae, fimbriate setae, such expressions seem in most cases entirely adequate.

In any case, it is not with terminology that this note is especially concerned. It is rather with the actual variety of form which is to be seen as one's interest ranges over the various groups of insects that lend themselves especially well to microscopic preparation that we have here to do. The writer of these lines having been engaged for many years in the study of insects that demand microscopic preparations and having adhered consistently to the principle that

descriptive work which is to be of permanent value requires adequate illustrations, has probably seen and drawn more setae than any other entomologist living or dead. It has in fact at times seemed that fate held little more in store for him than endless years of meticulously counting and as meticulously drawing setae upon the longitudinally divided outline representations of scale insects, jumping plant lice, sucking lice, biting lice, mites, Streblids, Nycteribiids, Hippoboscids and whatever other miscellany might come within his purview. It is from this experience, with the addition of a few things that have been examined in connection with the preparation of this note, that the examples shown have been drawn. They are presented because of the fact that the subject is but inadequately considered in general texts and some of the most interesting developments are unknown to any but specialists. Sensory setae and the scales of Lepidoptera, having received a very large amount of attention by many authors are not here touched upon.

The vast majority of all setae forming the vestiture which may even entirely conceal the body of many insects, are merely a hollow, tapering shaft, always with the walls strongly sclerotized. They are in effect nothing more than very slender cones of circular cross-section. They may range in form and size (Fig. 1A) from minute points to long, slender hairs or relatively enormous, stiff bristles such as those of Tachinid flies. Such bristles, on the one hand, and the soft pile of a Mutillid or of a *Pleocoma* beetle represent nothing more than differences in diameter relative to length.

Modifications through extreme shortening and broadening, while retaining the circular cross-section, are very common. Beautiful examples are to be seen in many of the scale insects. In Fig. 1B-D, F, K are forms to be found as characteristic features of certain species of the genus *Eriococcus*, the most notable, perhaps, being the almost nipple-like setae of *E. eucaalypti*. Truncate, almost cylindrical setae with a more or less strongly expanded base (Fig. 1G, L) are distinctive features of the cochineal insects of the genus *Dactylopius*. And in the species of the genus *Eriopeltis* the body is thickly beset with setae of various sizes, but all in the shape of the frustum of a stout cone (Fig. 1J). In the genus *Ceroplastes* the stigmatic depressions are usually beset with tubercle-like setae of various forms, those of *C. rubens* (Fig. 1H) varying from a shape that is practically spherical to one that can best be described as acorn-like.

Most of the ectoparasitic insects tend to be quite hairy and although the setae are generally of an ordinary form they are at times very characteristically shaped. A strongly fusiform type such as shown in Fig. 1I occurs characteristically in the Anopluran genus *Hoplopleura*, strongly clavate setae with truncate tips (Fig. 1R) are especially strongly developed in *Eulinognathus denticulatus* and almost cylindrical, truncate setae are found in *Enderleinellus suturalis* and related forms. Slightly fusiform, almost spike-like setae are common in the genus *Pediculus* (Fig. 1Q) and in *Haematopinus*.

The very hairy Hippoboscidae show no peculiar developments, but in certain of the Streblidae, notably *Euctenodes* and *Nycterophilia*, there are developed heavy setae with curious, pseudo-spiral markings, a type (Fig. 1M) that I have not seen elsewhere.

Throughout the ectoparasitic insects especially—although by no means confined to them as has sometimes been thought—there is a tendency toward

the development of conspicuous combs or ctenidia composed of very heavy setae arranged in a closely set row. While the individual setae are merely unusually stout and sclerotic developments of the ordinary type, the result of their arrangement is a structure that presents a number of problems of interest that can not be discussed here. In some cases the individual setae are marked by longitudinal furrows, such being the case in the Nycteriidae, *Cyclopodia roylei*, from which a portion of the abdominal ctenidium is here shown (Fig. 1N).

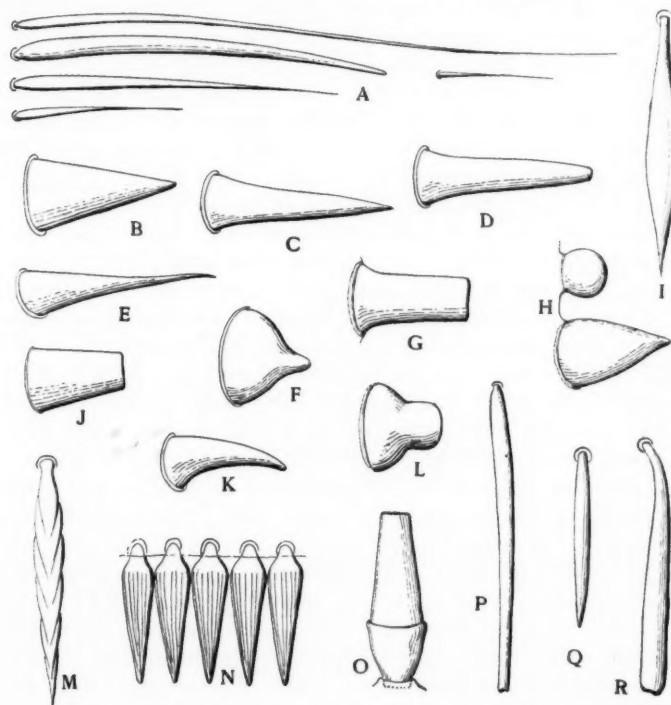


Fig. 1. A, simple types of setae; B, C, D, E, F, K, setae from *Eriococcus bahiae*, *villosus*, *coccineus*, *quercus*, *eucalypti* and *bahiae* respectively; G, L, from *Dactylopius tomentosus* and *D. indicus* respectively; H, from *Ceroplastes rubens*; J, from *Eriopeltis festucae*; I, from *Hoplopleura scuricola*; M, from *Nyctophilus coxata*; N, portion of a ctenidium from *Cyclopodia roylei*; O, sectaseta from *Triozza*; P, from *Enderleinellus suturalis*; Q, from *Pediculus humanus*; R, from *Eulinognathus denticulatus*.

Types achieved by a departure from the normal conical form with circular cross section are by no means uncommon. The most familiar, of course, is to be found in the scales of butterflies, which will not here be discussed. However, setae so flattened and broadened as properly to be called scales are by no means rare in other groups, cropping up occasionally in the most unexpected places. In the sucking lice there is a group of species restricted to marine mammals of the Order Pinnipedia, the seals and sea lions and their kindred. Here, perhaps as some have thought correlated with the peculiar environment, there is a remarkable development of flattened setae and scales. In the louse of the walrus, *Antarctophthirus trichechi*, for example, every step from relatively enormous,

flattened but still quite thick, almost trowel-like setae (Fig. 2-L) through smaller flattened setae (Fig. 2F) to extremely thin, delicate scales (Fig. 2K) is to be found. In this small group of scaled species the scales take various shapes, Fig. 2M, showing a scale from the louse, *Antarctophthirus callorhini*, of the Alaska fur seal.

Whether the development of scales in these lice of marine mammals is or is not due to some environmental factor, something of the sort occurs in other lice whose hosts are certainly not especially aquatic. In the louse of the elephant, *Haematomyzus elephantis*, most of the few setae present are flattened and leaf-like, although scarcely thin enough to be called scales (Fig. 2G), while in another louse, *Ctenophthirus cercomydis*, from a South American rodent, there are developed setae (Fig. 2H), of a leaf-like form that may be regarded as essentially scales. Even in certain of the scale insects there are similar developments. In the genus *Paralccaniium* the marginal setae form a closely set row (Fig. 2D) of delicate, fan-like structures that are essentially scales.

The scales of Coleoptera were investigated many years ago by Dimmock, who found them in a number of beetle families. His work seems almost to have been forgotten, although embodied in a quite extensive paper and bearing the evidences of careful observation. I have included here figures of scales from three species of Coleoptera. In Fig. 2J is a scale from a species of the Elaterid genus *Alaus*, characterized by deep, longitudinal furrows; in Fig. 2P a scale from a weevil of the genus *Alcides*, these scales being very delicate, strongly fimbriate and unmarked by furrows or ridges; and in Fig. 2O a scale from an undetermined weevil, this being marked by strong, longitudinal ridges. Dimmock has discussed at length the iridescent scales of the weevils, which, curiously enough, are structurally apparently very simple, the iridescence arising perhaps from extraordinarily delicate films.

Slender setae, with the tip alone flattened and spatulate are very well developed in Chermid (= Psyllid) nymphs of some species of *Psyllia* and related genera (Fig. 2A). In many of the scale insects of the genera *Coccus*, *Pulvinaria* and related forms there is a strong tendency for the marginal setae to be flattened and more or less fimbriate at the apex. An especially well developed example of this, from *Coccus caudatus*, is shown in Fig. 2N.

In one of the sucking lice, *Hoplopleura disaggrega*, there occur peculiar setae (Fig. 2E), short, stout, with the tip flattened and presenting an appearance as if the setae has been broken, leaving only a stub. From the regularity of its occurrence, however, it is evident that this form is not the result of an accident.

Setae in which some degree of lateral branching occurs are by no means uncommon. They reach their highest development in the bees, where, as is well known, forms that may fairly be described as plumose are developed. On an individual bee a variation ranging from merely slight lateral points to the strongly branched structure of Fig. 2Q, which is from a bee of the genus *Xylocopa* may be found. In the larvae of Dermestid beetles the remarkable vestiture of setae is composed in part of a branched type. Here the lateral branches are very short and numerous, the whole having an appearance that suggests the term "rat tail setae," as properly descriptive. These setae (Fig. 2S) reach relatively extraordinary lengths and are usually mingled with another

type which will be described later.

A most unusual series of developments that fall within no standard class occurs in the strange larvae of the beetle genus *Brachypsectra*, which has been

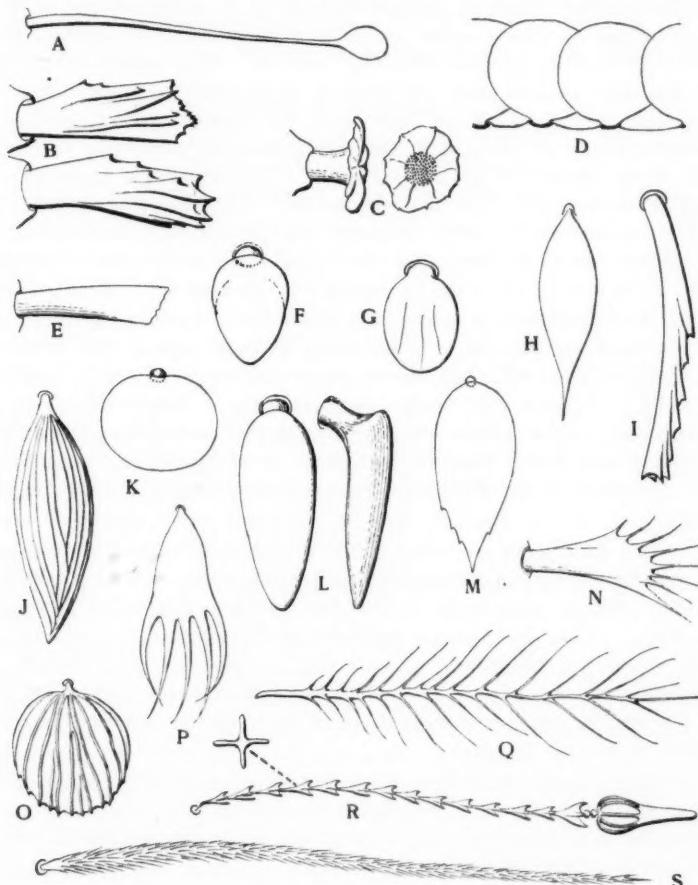


Fig. 2. A, spatulate seta from *Psyllia* nymph; B, C, from larva of *Brachypsectra* sp.; D, from *Paralecanium luzonicum*; E, from *Hoplopleura disgrega*; F, K, L, flattened setae and scales from *Antarctophthirus trichechi*; G, flattened seta from *Hacmatomyzus elephas*; H, scale from *Ctenophthirus ceromydis*; I, from *Cimex lectularius*; J, O, P, scales from *Alaus* sp., *Alcides albocinctus* and undetermined weevil respectively; M, scale from *Antarctophthirus callorhini*; N, fimbriate seta from *Coccus caudatus*; Q, from *Xylocopa* sp.; R, "pendicle seta" from larva of Dermestid beetle; S, "rat tail" seta from the same.

referred by Blair to a distinct family the Brachypsectridae. Here the dorsum is thickly studded with setae of a nail-like form, the apex being strongly flattened (Fig. 2C). These setae grade through various intermediate stages to a type, found only around the margins of the body, that is somewhat flattened and irregularly ridged and spurred toward the apex (Fig. 2B).

And even the common bedbug bears setae of a type somewhat similar

to these last, although more regularly formed. Here the setae are more or less cylindrical, curved, with the convex side quite strongly serrate (Fig. 2I) and the apex spurred. Such setae appear to be common to all the Cimicidae.

But the type which in strangeness—and in a certain beauty of design—seems to surpass all others occurs on the larvae of Dermestid beetles. Here, in at least some species, mingled with the "rat tail" setae already described, are shorter and more delicate setae that seem to be the ultimate of all these curious developments. As far as I am aware they are undescribed, or, if somewhere in the literature of the Coleoptera they are indeed recorded, they are but little known. They consist (Fig. 2R) of a very slender shaft, which at regular intervals is swollen into four thin expansions. The number of these serially arranged structures varies with the length of the seta and the terminal one is usually larger than those preceding. It is then followed by one or two minute, spherical beads and then the setae expands into its final achievement, a terminal somewhat arrowhead-like structure of circular cross section, strongly swollen at the base and tapering to a blunt point, with the apical half continuously sclerotic but the basal half membranous except for apparently eight longitudinal, sclerotic ribs. The type is so distinct that it deserves a special name. In casting about for some word or phrase that might be applied to it I have been unable to hit upon anything better than to characterize it as "pendicle setae," the word pendicle, according to the dictionary being sometimes used to mean "a pendant ornament."

To one other type of setae, peculiar but not so elaborate as these just described, I have previously applied another special term. These are setae (Fig. 1O) which seem to occur only in Chermid (=Psyllid) nymphs, especially of the Triozinae. They appear as a swollen, cup-like base, distinctly marked off from the cylindrical frustum of a cone which forms the apical portion. In a few cases this apical portion is acute and the whole seta has a lanceolate appearance. Because of the divided appearance I have elsewhere proposed the term "sectaseta" to characterize them.

The various developments to be seen in the setae of Lepidopterous larvae, have been described by several workers and need not here be considered. But in all probability a search through all the groups of insects will reveal still more strange types not here-to-fore brought to light.

A NEW SPECIES OF HOPPINGIANA FROM BRITISH COLUMBIA. (COLEOPTERA : MELYRIDAE).

BY FRANK E. BLAISDELL, SR.,

Stanford Medical School and Associate in Research California Academy of Sciences,
San Francisco, California.

In January of 1924 (Can. Ent., vol. LVI, No. 1, p. 2.), I created the genus *Hoppingiana* to receive a species of Melyrid that did not fit into any of the previous generic definitions. Of late considerable discussion has arisen over the possibility that *Hoppingiana brevilabris* Blais. is the true *Dasytes hudsonicus* of LeConte. My male specimen of *hudsonicus* Lec. was received from Wickham and was collected in the alpine regions of Colorado. I find it difficult to separate this specimen from the male of *brevilabris* Blais. The genotype of *Dasytes*

Paykull is the *ater* of Fabricius (Paykull, Fauna Suecica, Upsala, I, 1798). If *brevilabris* Blais. is the true *hudsonicus* Lec. it appears quite right to transfer it to *Hoppingiana* Blais. as the genotype of that genus. These remarks are based on the studies of my esteemed associates, H. C. Fall and Ralph Hopping.

At the present time I am describing a new species of *Hoppingiana* which is as follows:

***Hoppingiana monticola* n. sp.**

Form oblong-subovate, moderately depressed, a little less than three times as long as wide. Color black, mouth-parts, tibiae and tarsi more or less piceous. Pubescence short, recumbent, without intermixed erect setae, moderately dense but not concealing the body surface and flavo-cinereous to cinereous in color; longer on the prosternum and coxae, few longer setae about the mouth; lateral pronotal fimbriae very short and inconspicuous.

Head triangular before the post-ocular line, muzzle short, widest across the eyes and there one-half wider than long; sides before the eyes convergent and not in the least prominent, antennal insertion almost exposed. Frons almost plane, broadly and feebly impressed, punctures small, not well defined and separated by a distance equal to two or three times their diameters. Eyes rather large, oval, moderately prominent, facets not coarse, not setose. Antennae slightly longer than width of the pronotal apex, slightly dissimilar in the sexes; first segment stout, second globose, third rather slender and obtusely conical, fourth to the eighth inclusive subequal in size and width.

Pronotum in length about equal to width of apex, widest at base; apex subtruncate in moderate circular arc, angles obtusely rounded and not in the least prominent; sides convergent anteriorly, broadly, evenly and less than moderately arcuate in middle third, less so anteriorly, somewhat sinuate before the basal angles, the latter somewhat obtusely prominent laterally; base broadly and rather strongly lobed, sinuate laterally within the apparently advanced angles, one-half wider than the apex. Disk moderately and evenly convex in the central area within the submarginal impressed lines, the latter rather strong, arcuate, not quite attaining the apex, curving inwards posteriorly and continuous with the fine basal groove; surface between the submarginal line and lateral margin more strongly convex and rather abruptly declivous to the margin, feebly and obliquely subgibal within the basal angles; surface rather glutaceous, punctuation fine, submarginal area subsperate. Prothoracic sides more or less convex, lateral pronotal margin not in the least prominent.

Elytra oblong, scarcely wider posteriorly, at middle about one-sixth wider than the pronotal base, twice as long as wide and about three and one-half times as long as the pronotum; humeri rounded, sides parallel, broadly and feebly arcuate, becoming more strongly arcuately convergent in apical third, continuously so with the apex, sutural angles obtusely rounded. Disk moderately convex, arcuately precipitous laterally, very gradually so apically; punctuation fine and rather dense. Scutellum subquadrate, feebly arcuate at apex.

Body beneath very finely and densely punctate. Abdomen moderately convex, segments two, three and four quite equal in length, fifth about one-third longer. Legs rather short and slender; metatibiae a little longer than their femora,

the latter attain the apex of the third abdominal segment. Fifth metatarsal segment as long as the second and third taken together.

Male.—Usually narrower and generally smaller. Antennae a little more incrassate distally, segments more transverse, eleventh stouter and ovate. Fifth ventral abdominal segment truncate and feebly arcuate at apex and with a small oval or somewhat elongate impression.

Female.—Generally larger and somewhat broader. Antennae less incrassate distally, segments nine and ten scarcely transverse. Fifth abdominal segment arcuate at apex, surface not impressed.

Measurements.—(Types). Length 3.5-4 mm.; width 1.5-1.8 mm.

Holotype, female, No. 3849, in the author's collection, Museum of the California Academy of Sciences.

Allotype, male, in the Canadian National Collection, Ottawa.

Paratypes in collections of Ralph Hopping, Mr. Smith and that of the author.

A small series studied, all collected at Copper Mountain, British Columbia, at an elevation of 4300 ft., on June 20, 1930, by Mr. G. Stace Smith. It occurs on *Potentilla*.

Monticola is readily distinguished from *brevilabris* Blais. (See introduction) which also occurs in British Columbia; *kingi* Brown was based on the female of *brevilabris*. In the latter the pubescence is brownish with intermixed erect black setae that are longer on the head and pronotum, besides the head and pronotum are more densely and asperately sculptured.

In both species the ungual appendages are oblong, rounded at apex and scarcely as long as the claws in fresh specimens, often appearing shorter from shrinkage or wrinkling, free in distal half and equal. In *Dasytes* the appendages are equal, very small and rudimentary. LeConte remarks concerning *Dasytes hudsonicus* (Proc. Acad. Nat. Sci's of Phila., Dec. 1866, pp. 359-360.), "the unguis at the base are dilated into an obtuse rounded lobe, basal dilatation two-thirds as long as the claws (synopsis), which leaves only one-third of the claw free. The type is a male from the Hudson Bay Territory."

TWO INTERESTING NEW BEES.

BY T. D. A. COCKERELL,

Boulder, Colorado.

The bees now described are of interest for different reasons. The genus *Hesperapis*, originally described from New Mexico, has been found to be widely distributed over the southwestern States, with eighteen species, two of which come from Lower California. *H. carinata* Stevens, a large species from North Dakota, represents an unexpected extension of range. Recent studies of the bees of South Africa have shown that the genus *Capicola*, with numerous species in the dry regions of the Cape Province, cannot be separated from *Hesperapis* (see Natural History, XXXIII, p. 447). No species are at present known from Asia, or from North Africa. Thus the genus is of extraordinary interest, and deserves intensive study.

The genus *Protoxaea* belongs to a neotropical group of bees, which gets as far north as Texas, New Mexico and Arizona. These insects are large and

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handsome, and attract attention by nesting in large colonies or towns (see American Naturalist, LXVII, May-June, 1933). Mr. Parks has discovered a case which appears to represent the beginning of specific differentiation. From what I have seen of Texas bees, this State seems especially favorable for the study of such phenomena and also hybridization, on account of the meeting of different faunas, following differences in climate,—warmer or cooler, drier or moister. Bexar County, where Mr. Parks resides, is in the arid Lower Austral Zone, but it is no great distance to the humid Lower Austral eastward, and to the upper (or middle) Austral to the northwest.

***Hesperapis carinata rodecki* subsp. n.**

Female. Length about 11 mm., anterior wing 8.5; like *H. carinata* Stevens, but smaller, with the wings conspicuously dusky at apex (perfectly clear in *carinata*); head shorter, the face very broad; the highly polished clypeus less distinctly punctured; smooth supraclypeal triangle with the upper part more distinctly defined; flagellum bright red beneath; deep pit on posterior face of metathorax shaped like the end of a finger (subconical in *stevensi*); first two tergites not nearly so broad in proportion to their length; apical plate broader; fringe of fifth tergite and hair at sides of apex brownish grey (white or nearly so in *stevensi*).

Colorado: Roggen, July 17, 1930 (*H. G. Rodeck*). Perhaps a distinct species.

***Protoxaea gloriosa pallida* subsp. n.**

Similar to *P. gloriosa* (Fox) but averaging smaller, and the pubescence of the thorax and abdomen, which is rich orange-ferruginous in *P. gloriosa*, pale tan color, though that on the legs of the female is richly colored as in typical *P. gloriosa*.

Texas: Bexar County, July 10 to September (*P. gloriosa* also flies from July to September in Bexar Co.), taken by Mr. H. B. Parks, who writes: "The bright colored ones through a long series are larger than the tan colored ones. When I first captured these bees I supposed that the color was simply a variation, but afterward on finding their 'towns,' I found the bright colored ones occupied one 'town' and the tan another. It looks to me as if they are separate species." I mounted the genitalia of both, and cannot see any difference. Whether the flower-visiting habits differ is not known. The case is an interesting one, deserving further study.

Mr. Parks also takes *P. texana* (Friese) in Texas, and remarks that the males from Houston and the vicinity are much smaller than those from San Antonio County. I find that *Oxaea tristis* Gribodo, of which I have a male from the San Bernardino Ranch, Douglas, Arizona, Aug. (F. H. Snow) must be called *Protaxaea tristis*, and is in fact very close to *P. texana*. The abdomen is suffused with green; the occiput has white hair (black in *P. texana*) and the hair at end of abdomen is white.

NEW SPECIES OF NORTH AMERICAN EPHEMEROPTERA IV*

BY J. McDUNNOUGH,
Ottawa, Ontario.

***Ephemerella ingens* n. sp.**

Male. Eyes deep black-brown. Head black with the pits of the antennae and a small area posterior to the mid-ocellus pale yellowish. Pronotum black; mesonotum black with slight brownish shading along lateral edges posteriorly; the membranous area between base of wing and fore coxa pale yellowish, shaded with light brown, and containing a blackish streak; metanotum black with slight yellowish tinges in median area; pleura and sternum black with the less heavily chitinized portions, especially around bases of legs, pale yellowish. Abdomen dorsally with lateral and posterior edges of segments smoky yellow or yellow-brown, most of segments II-VII occupied by a large quadrate median black patch and lateral circular patches of same color, indistinctly separated by bands of dull yellow-brown; on the rear segments the black areas more or less coalesce. Ventrally the light yellow-brown posterior banding of segments is broader and more distinct, remainder of segment blackish with a slight ruddy tinge and faint traces of small oblique submedian pale streaks on anterior margin. Forceps dull brownish; setae black. Forelegs almost entirely blackish, tinged with pale smoky yellowish along edges of femur, especially near base; mid- and hind legs with blackish coxa and femur, the latter as well as the trochanter tinged with dull yellowish at base and along edges; tibia equal in length to femur plus trochanter, dull yellowish; tarsi smoky yellow (at times decidedly smoky). Wings hyaline with black-brown veins and cross veins, the latter somewhat indistinct in pterostigmatic region; no fusion of veins Cu₂ and 1st A.

Female. Somewhat paler in coloration than the male, but with similar maculation. Head black with a broad band of ruddy brown between the eyes, just posterior to the ocelli. Thorax considerably suffused with brown, some yellowish shading on the anterior portion of the mesosternum, and the pale shades around bases of legs quite extensive. Abdomen more definitely pale-banded both dorsally and ventrally and with lateral edges distinctly pale yellowish. Subanal plate blackish with well-defined apical excavation. Length of body 13-15 mm.; of forewing 16-18 mm.

In a male alcohol specimen the abdominal maculation is as follows: dorsally segments II-VII pale smoky amber with large, black-brown, median quadrate patches not quite attaining either margin and cut faintly by a narrow pale median line, the lateral borders slightly deeper in color than the central section; a series of large, circular, lateral patches of a similar color, narrowly separated from the median ones by a band of pale color. Segments VIII-X largely black-brown with faint ruddy tinge and only traces of the pale bands separating the dark median and lateral areas; posterior margin of IX narrowly whitish. Ventrally anterior half of segments I-VII deep black-brown, slightly ruddy and showing paler, obscure, oblique, submedian dashes on anterior margins of IV-VII with traces of median pale dots; segments VIII and IX largely blackish, the former with whitish posterior border.

*Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

Holotype—♂, Oliver, B. C., June 5, (A. N. Gartrell) (bred from nymph); No. 3760 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, June 14.

Paratypes—1 ♂, 2 ♀, same data, May 21, 28, June 12; also 1 ♂ (in alcohol)

June 25.

The species is undoubtedly very close to *grandis* Eaton from Colorado, as defined by Needham (1927, Ann. Ent. Soc. Am. XX, 108). I have no adult material from Colorado for comparison, but through the kindness of Dr. Needham some of his Logan, Utah, nymphal material is deposited in our collection and I am regarding this as typical of *grandis*. Mature nymphs of *ingens* from Oliver differ from those of *grandis* in the decidedly greater length of the tibiae, especially those of the hind legs, and the longer occipital tubercles. The thoracic and abdominal spining is very similar in both species; it might be noted that the subdorsal ridge in the central portion of the mesothorax is slightly better developed in *ingens* and in some females shows a distinct rounded wart; as in *grandis* the pair of spines on abdominal segment II are rather close together, those on III somewhat wider apart and those on the balance of the segments much wider apart; taken as a whole, however, the two rows of spines are closer together in *ingens* than in *grandis*. There is apparently also less of a gradual increase in size from the second to the eighth pair so that in consequence the difference in size between the spines of the seventh and eighth pairs is more marked, the latter being at least one and one-third times the length of the former; the spines of the eighth and ninth pairs show a tendency in *ingens* to bend slightly towards each other apically whilst in *grandis* they are either straight or slightly divergent. There is not much difference between the species in the length of the postero-lateral prolongations of the segments, and there appears to be a certain amount of sexual variation in this character. When long series are available for comparison it is quite possible that some of these rather slight differences will prove of little value as a means of separation.

Ephemerella flavitincta n. sp.

Male.—Head black, the pits of the antennae yellowish. Thorax shiny black with the membranous portions of the pleura dull yellow-brown, with brighter yellow around the bases of the legs. Abdomen dorsally black, the posterior margins narrowly pale yellow, most noticeably in lateral angles and on segments VIII and IX, the other portions being somewhat dulled (at least in specimen examined) with smoky brown. Ventrally black with rather bright yellow posterior borders to segments I-VII, posterior segments and forceps entirely black. Setae black, paling to pale smoky distally. Forelegs deep black, tarsi somewhat paler; mid and hind legs with coxa and trochanter blackish, separated by a narrow ring of yellow membrane, femur largely black, edged at base with yellowish, tibiae and tarsi rather bright yellow with claw-segment tinged with smoky. Wings hyaline, tinted with light amber, the color paling apically; veins and crossveins strong, blackish, latter faint in pterostigmal area; no fusion between Cu₂ and Ist A.

Female.—Paler than the male. Head posterior to ocelli yellowish, tinged with brown next the eyes and with the vertex broadly shaded with black-brown. Mesonotum largely suffused with light brown and the yellow areas on pleura

and at bases of legs bright and quite prominent. Abdomen, legs and wings much as in male with the dorsal yellow bands of former brighter in color. Subanal plate with a small, apical, V-shaped incision. Length of body 15 mm.; of forewing, 18 mm.

Holotype—♂, Luckiamute Riv. Hoskins, Ore., May 6, (R. Dimick) (bred from nymph); No. 3761 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, April 15.

Paratype—1 ♂, nymph, taken in a stream near Eddyville, Ore., on April 8th, and agreeing with the nymphal exuvia of the type.

I am much indebted to Dr. Dimick, who is investigating the Ephemerid fauna of Oregon for permission to retain these specimens.

The nymph is very similar to that of *glacialis* Trav., but considerably larger in every way, the male nymph being 16 mm. long as compared with 13 mm. for *glacialis*. The head is broader and the occipital tubercles better developed; on the pronotum the posterior one of the submedian pair is much longer than the corresponding tubercle in *glacialis*. Abdominal spining much as in *glacialis*, but the spines appear longer due to larger size of nymph. Viewed from beneath the lateral edges of the abdominal segments appear less convex than in *glacialis* and the posterior spine-like prolongations project in consequence more beyond the body-line.

The amber-tinted wings and the large size render the species one of the most striking in the group.

***Ephemerella spinifera* Needh.**

Ephemerella spinifera Needham, 1927, Ann. Ent. Soc. Am. XX, 110; Walley 1930, Can. Ent. LXII, 17, Pl. III, figs. 1-3.

As our knowledge of the western Ephemerid fauna increases it has become evident that there are several closely allied species in the *spinifera* group of the genus *Ephemerella*; it is of considerable importance, therefore, to tie down the above name correctly. It was based, unfortunately, on several immature nymphs from the Blackfoot River, Potomac, Mont. (June 20); one of these I have examined and the entire type series has been studied by Dr. J. Traver of Cornell University and compared with specimens of nymphs submitted by me. We both agree that the mature male nymph, from the Gardiner river, Yellowstone National Park, Wyoming (July 26) figured by Walley (*op. cit.*) is referable to this species. I append a detailed description of this nymph, which will supplement the original one.

Length of body, 11 mm., of tails, an additional 9 mm.

Color light brown, but this is probably due to fading in the alcohol and fresh specimens may be considerably darker and show an abdominal pattern. Head with a pair of long, erect, pointed tubercles on vertex, about as long as distance separating them. Pronotum with a twin pair of tubercles on each side subdorsally, situated on posterior half of segment, the anterior one being twice as high as the posterior one, both pointed; a lateral pointed tubercle at same level as anterior subdorsal one and somewhat smaller than this.

Mesonotum with a small pair of rounded wart-like tubercles, situated subdorsally on anterior margin; laterad and slightly posterior to these on each side is a longer, sharply pointed tubercle, directed slightly backwards; in central

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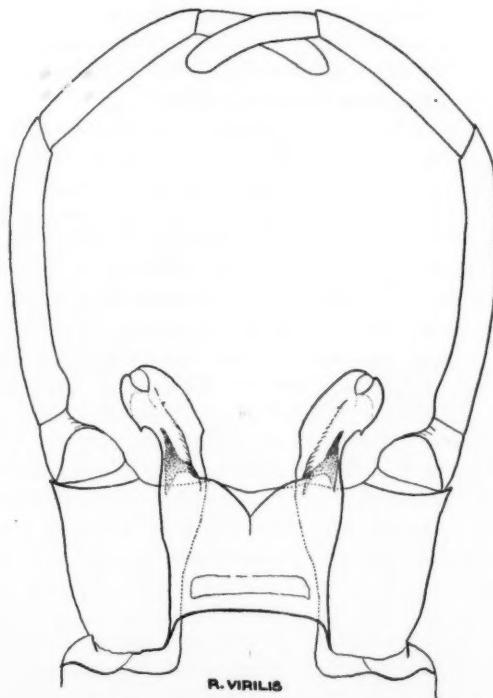
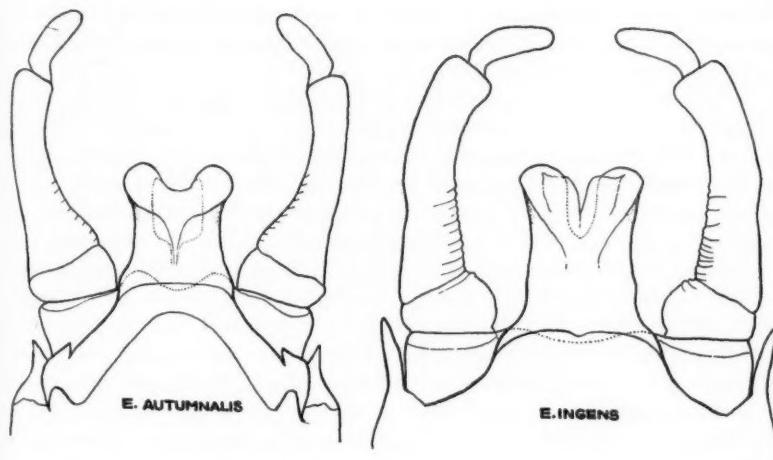
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PLATE 7



NORTH AMERICAN EPHemeroptera.

area is a pair of long, pointed subdorsal tubercles, twice as large as the preceding pair, and also slightly slanting backwards, and there is a single median rounded wart-like prominence on the posterior portion, equivalent to the scutellum of the adult; in the latero-anterior angle is a small rounded wart, separated by a slight excision from a still smaller wart, placed directly behind it; somewhat dorsad of these is a slight raised ridge.

On abdomen dorsally segments 2-7 bear each a pair of sharply pointed, spine-like tubercles on the posterior margin; these are all practically equal in length and directed slightly backward; the two on segment II are closer together than those on the following segments and on segments IV-VII the distance between the tubercles is slightly greater than their height. On segments VIII and IX the spine-like tubercles are enormously increased in size and fully four times the length of the preceding pairs; they are pointed and covered with long, scattered bristles, the pair on VIII faintly divergent apically, those on IX slightly smaller than on VIII, subparallel and rather more decumbent. Tails light brown in basal fourth, broadly ringed with darker brown in outer three-quarters. Lateral spine-like prolongations of abdominal segments III-VII increasing in size from front to rear; lateral margin of VII slightly convex, of VIII and IX distinctly sinuate, the prolongations on these last two segments being subequal and somewhat longer than on VII. Ventrally on abdomen are sub-lateral rows of dark brown dashes, one dash to each segment. Legs pale brown, the femora of two posterior pairs showing traces of two dark transverse bands on outer sides; hind tibia equal in length to femur and trochanter combined.

Ephemerella autumnalis n. sp.

Male. Eyes deep red-brown. Head black, the circular pits of the antennae and a small area posterior to mid-ocellus pale yellowish. Pronotum black with yellowish shades laterally at bases of prolegs; mesonotum black shaded with pale yellow-brown as follows:—a lateral streak extending forward from base of wing, the lateral edge of the anterior projection, the lateral posterior edges reaching caudad to beginning of scutellum and relieving in this region a black dorsal band as broad as and extending over, scutellum; metanotum black with slight yellowish median shading on posterior projection; pleura black with the less heavily chitinized parts, especially at bases of legs, pale yellowish or yellow-brown; sternum black. Abdomen dorsally black, with the anterior margins inclined to paler, the latero-posterior angle with a small pale yellowish spot and the posterior margins of segments IX and X bordered with pale yellowish; ventrally blackish with faint ruddy tinge and both anterior and posterior borders indistinctly palish, especially the latter on the two rear segments which show a distinct pale yellow margin. Bases of forceps pale yellow-brown, forceps blackish, paling to yellow-brown apically. Setae black. Forelegs with the femora and tibiae subequal, light amber, heavily suffused with blackish, the pale color only showing at bases of femora and at joint, tarsi paler, light smoky amber; mid- and hind legs with tibia equal in length to femur plus trochanter, both light amber with femur suffused in apical third with blackish, tarsi and claw darker in color, dull smoky. Wings hyaline, tinged slightly with smoky costo-apically, with rather fine, dark veins and crossveins, the latter paler in the pterostigmatic region.

Female. Quite similar to male. Vertex of head blackish with a broad curved band of light brown extending between eyes just posterior to the ocelli; the lighter areas on both thorax and abdomen better developed, so that both dorsally and ventrally the abdomen appears banded with light yellow-brown, with segment X dorsally almost entirely this color; the genital plate at posterior margin of segment VII is rather strikingly bordered with pale yellow, the subanal plate largely light brownish, broad apically and with a distinct but shallow excavation. Length of body, 11 mm.; of forewing 15 mm.

Holotype—♂, Shingle Creek Road, Keremeos, B. C., Sept. 8 (A. N. Gartrell) (bred from nymph); No. 3759 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, Sept. 7.

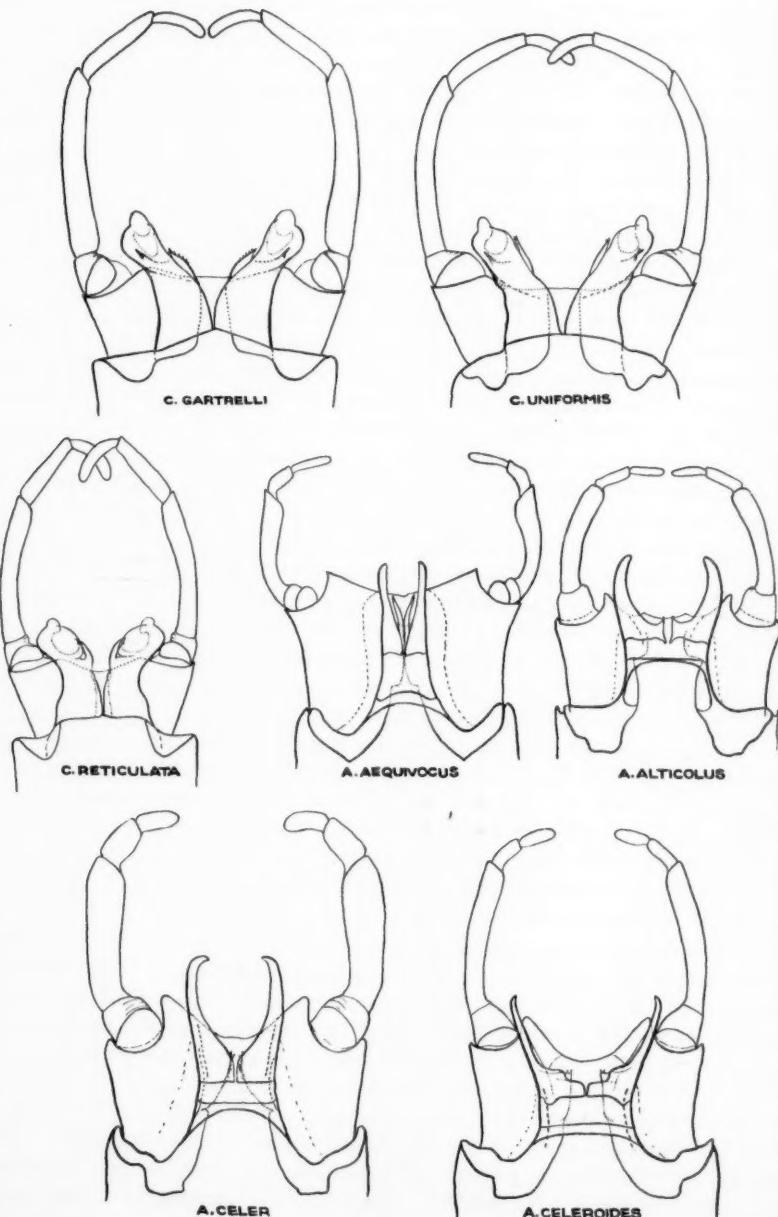
Paratypes—2♂, 1♀ (dried) same data, Aug. 27, Sept. 2, 3; 1♂ (in alcohol) same data as holotype.

The nymph is much the same size as that of *spinifera*, but appears considerably darker; this may, however, be merely due to the fresher condition of the material, the abdominal markings of the adult showing through subcutaneously. The arrangement of tubercles is essentially the same as in *spinifera*, the following differences being noted:—the twin pair on pronotum are subequal, the posterior one being larger than in *spinifera*; the lateral posterior spine-like prolongations of abdominal segments VIII and IX, but notably of IX, are shorter than in *spinifera*; the long dorsal spines of segment VIII are more strongly bent backward and downward. These differences are slight and may not always be constant, but when we combine with this the fact that the *spinifera* nymph apparently matures at high altitudes in the main chain of the Rocky Mountains in late July, whereas *autumnalis* nymphs are not mature at quite low levels until fully a month later, I believe we are justified in holding the two as distinct species.

It might be noted that, whilst both in holotype and allotype the venation is normal as regards the non-fusion of veins Cu_2 and 1st A., it is variable in the paratypes, one male showing non-fusion on one side and fusion on the other and the female showing fusion on both sides; the character is obviously of no subgeneric value and varies in our series of all the larger western species, including *doddsi* Needh. for which the subgenus *Eatonella* was erected, largely on the strength of the fusion of these veins.

From the male alcohol paratype the following description of the abdominal maculation is drawn up, it being more clearly visible in such a specimen:—

Dorsally segments I and II almost entirely black; segments III-VII blackish, narrowly pale smoky on anterior margin, more broadly so on posterior one, especially in median area; traces of a geminate dark median line, filled with pale color; on segments V-VII there is a tendency for the black area to break up into three patches, due to paler submedian prongs projecting from the posterior pale area into and almost separating the dark area; laterally there are faintly pale comma-like marks in the dark areas. Segments VIII and IX almost entirely blackish except for a narrow whitish posterior band; segment X pale, narrowly dark on anterior border with median and lateral prongs projecting backward into the pale area. Ventrally segments II-VII narrowly pale anteriorly, broadly pale posteriorly (almost one-third of segment), remainder of segment blackish with following pale markings:—A pair of oblique, submedian, lunate



marks, based on anterior pale area, two small centrally-placed, median dots and a somewhat larger lateral dot or dash, all rather obscure; segments VIII and IX black, the former with pale posterior border.

Genus *Ameletus* Eaton

With the accumulation of nymphal material from various sections of Western Canada and the association of nymphs and adults through breeding experiments it has become evident that there are several closely allied species in the *velox* group which have been confused under the one name on account of the similarity of the male genitalia. A discussion of these species follows:—

Ameletus velox Dodds

Ameletus velox Dodds, 1923, Trans. Am. Ent. Soc. XLIX, 105, Pl. VIII, figs. 16, 17; Dodds and Hisau, 1924, Ecology, V, 139, Pl. 1, fig. 1.

An excellent figure of the large nymph of this species is given by Dodds and Hisau, and the characteristic dark stripes on the gills, at about one-fourth the width of the gill from the dorsal margin, is clearly indicated. The gills are broad and well-tracheated and in my figure (fig. A) the finer detail is shown; the tails are blackish, tipped with white and very broadly haired.

The species appears to be uncommon in Canada and the only record we have so far is based on a single mature nymph from Glacier Creek, Crow's Nest Pass, Alta., taken on June 9, 1930, by J. H. Pepper. Other nymphal material before me includes one of the type lot from Tolland, Colo., and a single nymph from the Gardiner River, Yellowstone National Park, Wyo., July 26, 1928. I have examined no adult specimens, but, to judge by the size of the nymph, should imagine the species will prove to be one of the largest in the genus.

Ameletus celer n. sp.

Male. Head and thorax black-brown, the postero-lateral edges of the pronotum and the membranous parts of the pleura paler brown. Abdomen dorsally with segments II-VII semihyaline, pale ochre-brown with numerous fine tracheae, posterior margins of segments dark sepia brown with narrow brown subdorsal bands projecting forward from this area, but not attaining anterior margin; posterior segments somewhat deeper in color and opaque. Ventrally somewhat paler than above, without dark bands on posterior margins, but with a median row of dark, oval, ganglionic patches; area at base of forceps paler than preceding portion. Setae whitish with slight smoky tinge, narrowly ringed with black-brown. Legs sepia-brown. Wings rather dull hyaline, due to a very faint smoky tinge; veins fine, brown, cross-veins very fine, light brown and rather faint. Genitalia with the forcep-joints rather clumsy, the penis-lobes close together and subparallel, with fine spining ventrally at their bases.

Female. Similar to male, but rather paler in color, especially on mesonotum. Head posterior to ocelli about same color brown as thorax, somewhat paler laterad of and anterior to lateral ocelli. Length of body, 13-14 mm.; of forewing, 13-14 mm.

Holotype—♂, Glacier Creek, Crow's Nest Pass, Alta., June 25, 1930, (J. H. Pepper); No. 3762 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—8 ♂, 11 ♀, same data.

The whole series was bred from subimagoes found sitting on the rocks bordering the creek; at the same time mature nymphs were plentiful in the creek and, while not actually bred through, may be safely associated with the above adults. In early July, 1923, I found at Waterton, Alta., in a very small stream running from Mt. Crandall, similar nymphs from which the subimagoes were also emerging, and the resulting adults agree with those from the Crow's Nest Pass. The species has been misidentified by myself as *velox* Dodds, but the nymphs are only about half the size of *velox* nymphs (10 mm. length) and show other excellent characters whereby the species may be differentiated. The gills (fig. b) are smaller and much less heavily tracheated and there is no dark interior band of chitin, but the *dorsal margin itself* is chitinized and appears black-brown; the tails are pale ochreous (not blackish) and much less heavily haired than in *velox*. Dorsally the abdomen is light yellow-brown to deep brown with a double row of submedian dark dashes, the included space being sometimes paler; segments VI and VII appear at times paler than the others, but the material has been too long in alcohol to be sure of any details of coloration. Ventrally the usual whitish dots are present in the antero-lateral corners of each segment and the ganglionic marks show subcutaneously. The legs are quite pale ochreous except the distal ends of the tarsi which are banded with deep brown; there is a faint smoky streak on the outer side of the femora.

Ameletus celeroides n. sp.

Male. Very close to the preceding, but smaller in size. Thorax decidedly shiny blackish; the postero-lateral corner of the pronotum creamy in color rather than light sepia-brown and this same creamy shade tends to replace the light brown shades on the abdomen, especially laterally on segments VI-VIII and ventrally on segments VII and VIII; there is also a pale creamy line on the lateral edge of segment IX, this being sometimes found also on the two preceding segments. The hind-legs are paler and duller than in *celer* and the wings seem to have none of the faint smoky appearance of this species; the cross-veins are very fine and quite indistinct. The genitalia have the forceps-joints rather thin and fine and the penis-lobes are broadly, divergent apically; the spining at the base ventrally seems to be limited to two small apical spines.

Female. Very similar to the male, the vertex of head shaded with creamy. Length of body, 8 mm.; of forewing, 8-8½ mm.

Holotype—♂, Penticton, B. C., June 22 (A. N. Gartrell) (bred from nymph); No. 3763 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

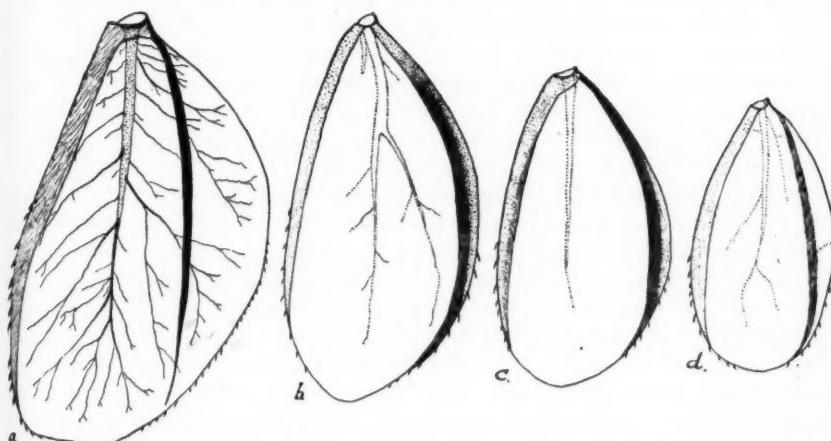
Paratypes—2 ♂, 4 ♀, same data, June 21, 22, 23, 26, 28; 2 ♂, 1 ♀, Mt. Apex, Hedley, B. C., (4,500 ft) Aug. 12, 13, 22.

The nymph is very similar to that of *celer*. The size is somewhat smaller; the gills are more heavily margined, especially on ventral edge, with a narrow dark, chitinized area and only very faintly tracheated (fig. c). The abdominal ground color is light brown with the usual darker submedian rows of spots or dashes, but there seems to be a greater extension of the pale suffusion dorsally than in *celer*, segments VI and VII both dorsally and ventrally and X dorsally being largely pale and II, III, and VIII showing considerably pale suffusion laterally; the tails are pale at the base and apex, the whole intermediate section

being deep smoky, giving a broad-banded appearance; the tarsi are dark-banded both proximally and distally. As already noted the nymphal material of *celer* at my disposal has probably faded considerably from its long immersion in alcohol, so that some of the above points may prove to be of little value as a means of separation when fresh nymphal material of *celer* is available.

Ameletus alticulus n. sp.

Male. Close to the preceding, but thorax and abdomen dorsally quite evenly deep brown, without any of either the blackish or pale coloration found in *celroides*. Head deep brown with pale shading laterad of the antennae. Thorax deep brown, pronotum faintly tipped with creamy at postero-lateral angle; anterior portion of mesonotum edged laterally with a creamy line, tinged



Fourth Gill of (a) *Ameletus velox* Dodds, (b) *A. celer* McD., (c) *A. celroides* McD., (d) *A. alticulus* McD.

with pink; a creamy patch with slight pinkish shading anterior to wing base; pleura as usual shaded with creamy-brown. Abdomen dorsally rather even, deep, shiny brown with little deepening of color along posterior margins of segments, ventrally pale creamy, with the usual dark ganglionic marks. Forelegs dark brown; mid and hind legs rather pale, creamy-brown. Wings hyaline; veins fine, brown; cross-veins pale, indistinct, except in costo-apical area, where they are brown and finely anastomosed. In the genitalia the forceps are rather short and stumpy and the excavation of the apical margin of the forceps-plate is much less deep than in the two-preceding species; the penis-lobes are rather broad and short and there appears to be no ventro-basal spining. Length of body, 8 mm.; of forewing, 8 mm.

Holotype—♂, Blairmore, Alta., June 23, 1930, (J. H. Pepper); No. 3764 in the Canadian National Collection, Ottawa.

Paratype—♂, same data.

This species has not actually been bred from the nymph, but the following association is fairly certain of being correct as the material was taken at the same time and place as the type subimagoes and is fully mature. According

to this association the rather slender nymph is almost entirely light brown with faint double row of dorsal abdominal dark streaks or dots and pale tails. Ventrally the abdomen shows as usual the white dots in the latero-posterior corners and the median ganglionic marks. The characteristic feature is found in the gills, which show *blackish chitinized bands slightly inward* from dorsal margin (fig. d), approaching *velox* in this respect, but of course, differing greatly in the much smaller size and almost entire lack of tracheation. I have examined similar nymphs from Cameron Lake, Waterton Park, Alta., Aug. 31, 1929, (altitude 5,600 ft.) (J. H. Pepper).

Ameletus aequivocus n. sp.

Belongs in the *cooki* group but differs in the browner coloration and details of genitalia.

Male. Head dark brown. Pronotum rather deep brown; mesonotum light brown shaded with black-brown laterally and broadly so posteriorly in the regions laterad of the scutellum; pleura and sternum deep brown, with the membranous portions pale brownish; metanotum brown, shaded with black-brown posteriorly. Abdomen dorsally with segment I black-brown, segments II-VII with anterior margin and a large subtriangular lateral patch pale, semihyaline, remainder of segments light brown, this color extending forward laterally almost to anterior margin; segments VIII-X opaque and more uniformly brown with paler brown patches laterally on IX and X. Ventrally segment I light brown, II-VI light ochreous, VII-IX light brown with posterior portion of IX and the genital plate somewhat paler; no ganglionic dark marks. Setae pale, dull brownish white. Forelegs with femora and tibiae deep brown with faint purplish tinge, tarsi pale brownish; mid and hind legs pale brownish with traces of a ruddy streak on femora on outer side. Wings hyaline, veins fine, brown, cross-veins indistinct, faintly tinged with brown, except in costo-apical area, where they are better defined and regularly anastomosed. Length of body, 9 mm.; of forewing, 9 mm.

Holotype—♂, Gunnison River, nr. Almont, Colo., 8000 ft., June 25, (A. W. Lindsey); No. 3765 in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, same data as holotype; 1 ♂, Tolland, Colo., July.

The species is duller in coloration than *cooki*; in the male genitalia the basal plate is broader with the projections from posterior margin differently shaped; the penes are closer together and the stimuli are considerably longer.

(To be Continued)

SOME UTAH LEAFHOPPERS¹.

BY GEORGE F. KNOWLTON,²

Logan, Utah.

During the past few years it has been possible to collect leafhoppers in many parts of Utah. Because of the abundance of many of the species and the fact that so many feed upon range forage plants, it seems to the writer that the injury due to range leafhoppers in the Rocky Mountain West has been greatly underestimated. The writer is indebted to Mr. P. W. Oman of the United States

¹Contribution from the Department of Entomology, Utah Agricultural Experiment Station; publication authorized by Director, 16 January, 1934.

²Associate Entomologist.

Bureau of Entomology for the identification of most of the species here recorded, except the *Erythroneura*, which were named by Dr. R. H. Beamer of the University of Kansas. Unless otherwise indicated, collections were made by the writer.

Family CICADELLIDAE (Latreille)

Agalliopsis novella (Say). Logan, June 7, 1931 (T. O. Thatcher); Monticello; June 18, 1933; Providence, June 3, 1930 (M. J. Janes).

Acratagallia pallida Oman. Clive, June 22, 1923.

A. californica (Baker). On sugar-beets at Collinston, July 21, 1927; on sugar-beets at Plain City, Sept. 2, 1927.

A. fuscoscripta Oman. Bluff, June 19, 1933; Iosepa, in Skull Valley, June 22, 1933.

A. dondia Oman. Grantsville, Aug. 28, 1933.

Idiocerus amabilis Ball. Fort Bridger, Wyoming, Aug. 4, 1932 (Knowlton: : Janes). Probably occurs in northern Utah.

I. nervatus Van D. On sugar-beets at Ogden, June 9, 1927; Toquerville, June 26, 1933.

I. pallidus Fitch. Logan, July 20, 1929; Salt Lake City, June 22, 1926.

I. suturalis Fitch. Wanship, July 19, 1932.

I. alternatus Fitch. Blue Creek, Apr. 10, 1930; Hyde Park (Janes); Logan; Logan Canyon; Orderville; Plain City; Providence; Santa Clara.

I. ensiger Ball. Brigham, on currant, Aug. 21, 1933; Logan, Aug. 5, 1933; Marysville, June 19, 1933; Mills, May 19, 1933; Moab, June 18, 1933; Ogden, on *Salix*, Aug. 9, 1933.

I. femoratus Ball. (?) Logan Canyon, June 17, 1933; on *Salix* at Roosevelt, June 21, 1933.

I. lachrymalis Fitch. Logan, July 20, 1929; Midvale, July 23, 1929.

I. ramentosus (Uhl.) On *Salix*, Logan, Aug. 5, 1933.

Macropsis viridis (Fitch). Just north of Utah at Fort Bridger, Wyoming, Aug. 4, 1932 (Knowlton: : Janes). Probably occurs in Utah.

M. hesperia Breakey. Chester and Manning, June 28, 1933.

Latalus misellus Stal. Logan Canyon.

Bythoscopus rufoscutellatus (Bak.) Indian Canyon, June 18, 1933; Monticello, June 12, 1933.

B. bisignatus (Ball). Kanab, June 26, 1933.

Cicadella gothica (Sign.). Kanab, June 27, 1933.

Draeculacephala mollipes (Say). Richmond, 1910 (Titus); St. George, July 1928 (Pack).

D. minerva Ball. Logan, Sept. 2, 1925; St. George, July 8, 1932.

D. manitobiana Ball. Providence, Aug. 10, 1931 (D. M. Hammond).

D. noveboracensis (Fitch). Northern Utah.

Gypona octolineata var. *striata* Burm. Holliday.

G. unicolor Stal. Providence, July 27, 1930 (Janes).

Mesamia diana Van D. Blue Creek, June 17, 1930.

Osbornellus scalaris (Van D.). Echo, Aug. 4, 1932 (Knowlton: : Janes).

Platymetopius frontalis Van D. Mendon, June 25, 1933.

Hebecephalus callidus (Ball). Indian Canyon, June 12, 1933.

H. signatifrons Van D. Colton, June 12, 1933; Duchesne; Farmington; Fort

Duchesne, Grantsville; Indian Canyon; Kamas; Myton; on sugar-beets at Ogden; Plain City; Snowville.

Laevicephalus striatus (L.). Ballard, Aug. 5, 1932 (Knowlton: Janes); Indian Canyon, June 12, 1933; Monticello; Price; St. John; Snowville, Wellington.

L. helvus De L. Locomotive Springs, Sept. 20, 1933 (W. L. Thomas).

L. cinerosus (Van D.) Lampo, June 11, 1933.

L. debilis (Uhl.). Providence, June 8, 1930 (Janes).

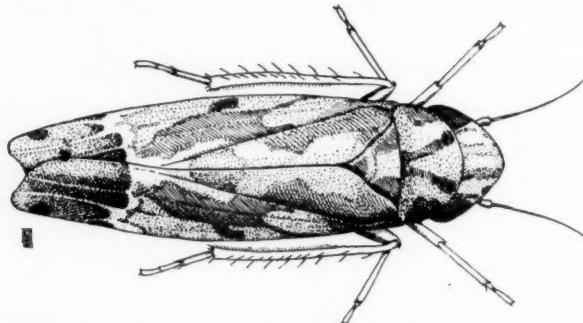


Fig. 1. Adult female *Erythroneura ziczac* Walsh. (Fig. in Leaflet No. 4, 1933).

Deltoccephalus fuscinervosus Van D. Providence, July 18, 1931 (Hammond); St. George, June 26, 1933; Yost, Aug. 13, 1929. Also collected at Stanrod, Idaho, Aug. 13, 1929.

Amphyipyga attenuata (Baker). On grass at Fort Duchesne, May 21, 1933.

A. occidentalis (Baker). On *Salsola pestifer* at Currant Creek, May 21, 1933; Lyman, June 27, 1926.

Athysanella utahna Osborn. Arthur, Sept. 16, 1925; Flux, May 13, 1933; Lynndyl, June 24, 1933; Warren, May 6, 1932.

A. robusta Baker. La Sal, June 18, 1933.

A. yumana Osborn. Salt Lake City, 1906 (Ball or Titus?).

Comellus sexvittatus (Van D.). Willow Creek, June 12, 1933.

Opsiust clarividus (Van D.). Delle, June 14, 29, 1929; Flux, Aug. 28, 1933; Green River; Iosepa, in Skull Valley; Lampo; on *Atriplex* at Timpie, Sept. 4, 1926. Also collected at Fredonia, Arizona, June 26, 1933.

Amphyipyga occidentalis (Baker). Colton, June 12, 1933.

Thamnotettix atropunctatus Van D. Tooele, June 14, 1929.

T. aureolus Van D. (?) Sardine Canyon, Aug. 9, 1933.

Chlorotettix lusorius (O. and B.). Logan Canyon, July 31, 1933.

Cicadula divisa Uhl. Colton, June 12, 1933; Ft. Duchesne; Monticello; Roosevelt; Soldier Summit.

Balclutha punctata (Thunb.). Logan Canyon, June 17 and July 31, 1933.

B. livingstoni (Baker). Logan Canyon, June 17, 1933.

Empoasca maligna (Walsh.). Mt. Pleasant, June 28, 1933.

E. patula De L. The Delle, in Skull Valley, Aug. 11, 1933.

E. pectinata De L. Chester, June 28, 1933. Specimens that appear to be this or a very similar species were collected at Logan Canyon, Manning, Spring City, and Sunset.

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Erythroneura coloradensis (Gill.). On grapes at Farmington, June 9, 1933.

E. cactra McA. Logan, July 31, 1933.

E. elegans McA. Damaging the leaves of grape and Virginia creeper in many localities including Brigham, Grantsville, Honeyville, Sandy, Salt Lake City, Magna, Millville, Ogden, and Logan. Also collected at Crescent, Hyrum, Orem, Providence, Redwood, River Heights, and Rosette. Commonly found in great abundance in company with *E. ziczac*.

E. ziczac Walsh. Often damaging the leaves of ornamental Virginia creeper and wild grapes, as well as cultivated grapes. Taken at Delle, Farmington, Hooper, Josepa, Lampo, Logan, Magna, Millville, Ogden, Perry, River Heights, Roy, Salt Lake City, and Sunset.

Dissections of adult and nymphal material of *E. ziczac* and *elegans*, collected at Logan, showed internal parasitism, apparently by a *Pipunculus* sp., to occur, but to be comparatively rare. It seems possible that insect predators and spiders play a more important part in the control of these two injurious species.

A damsel bug, *Nabis ferus* L., was observed to be feeding upon an adult *E. ziczac*, under natural conditions, upon a heavily infested grape leaf at Roy, August 9, 1933. The writer has found this species to readily attack both adult and nymphal beet leafhoppers, *Opsiush tenellus* (Baker), and some other species of leafhoppers.

Ladybird beetles of several species, and their larvae, have been noted upon Virginia creeper leaves damaged by "grape leafhoppers." Following such an observation, a nearly mature larva of a convergent ladybird beetle, *Hippodamia convergens* Guerin, was placed upon a Virginia creeper leaf in a 4-inch diameter celluloid cage with a number of fifth instar *E. ziczac* and *elegans*. A leafhopper nymph was seized almost immediately, being held and manipulated by the predator's pro-thoracic tarsi during the 7 minutes of feeding. A few seconds later the gluttonous predator captured another leafhopper nymph; during the process of feeding, this was held and manipulated by the pro-thoracic tibiae and tarsi. Only the legs of the two victims remained uneaten. A third victim was seized almost immediately and all but a few fragments of its body eaten within 6 minutes. A fourth leafhopper nymph was taken within a few seconds; however, before it had been completely devoured, the rapacious ladybird larva darted at and captured a nearby fifth victim and immediately commenced feeding upon the abdomen of its new prey. The head capsule and a small portion of the thorax of this leafhopper nymph was discarded at the end of 8 minutes, and 1½ minutes elapsed before the next leafhopper was captured. The pro-thoracic legs were used to capture and hold this prey, but soon after the leafhopper abdomen had been consumed, the predator ceased to use its legs while feeding upon the victim as it lay upon the leaf. At the end of 6½ minutes, the remains were discarded and a new victim captured, the abdomen again being the first part of the body to be eaten. Feeding continued for 7 minutes; then a new victim was captured. Two more victims were taken in the next 18 minutes, and then the appetite of the predator appeared to be temporarily gratified, as a rest of 43 minutes followed. Feeding was resumed, with 14 fifth instar *Erythroneura* nymphs having been killed and

their bodies largely to completely consumed during a total elapsed period of $2\frac{1}{2}$ hours.

It seems possible that ladybird beetles and their larvae in this area may be of some help in the control of leafhoppers upon ornamental Virginia creepers and upon grapes.

A CARABID BEETLE (LASIOTRECHUS DISCUS F.) NEW TO NORTH AMERICA.

BY G. CHAGNON,

Montreal, Quebec.

Among the many hundreds of interesting insects taken during the summer of 1933 in and about the extensive swamp of Lanoraie, in Berthier County, Province of Quebec, was found a specimen of a small and somewhat gaily colored Carabid which, having been submitted to well known specialists, proved to be identical with the European species *Lasiotrechus discus* F.

Portevin, in his "Coléoptères de France" Vol. 1, page 79, gives a short description of the species which reads as follows:

"Roux testacé, élytres avec une tache noire commune transverse, après le milieu; antennes dépassant le milieu du corps; pronotum cordiforme, à angles postérieurs aigus; élytres longuement ovales, à stries effacées en arrière; long. 5 mm. France centrale, méridionale et orientale."

The insect was taken at light near the railway station of Lanoraie on June 29th. A great many other beetles, mostly aquatic or subaquatic in habit, were also taken on the same night. *Hydrobius fuscipes*, *Enochrus ochraceus* and *hamiltoni* came in hundreds; *Heterocerus brunneus* and *tristis* were common; also countless *Agonoderus pallipes* and *pauperculus*, *Bembidion*, *Platynus* etc.

BOOK NOTICE

A Monograph of the Collembola of Iowa, by Harlow B Mills, XI+143 pp., 180 fig. Collegiate Press, Inc., Ames, Iowa, 1934. Price \$2.25.

This work consists of keys, descriptions, and illustrations for 132 species of springtails. It forms a comprehensive manual, as 59 of the species considered are known to be holarctic or cosmopolitan and all Nearctic and Palaearctic genera likely to be encountered in North America are keyed out and described. One genus, 32 species, and 3 varieties are described as new; several of these descriptions are the work of Dr. J. W. Folsom. A selected bibliography of 93 titles is included.

Date Mailed, August 1st, 1934.

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